38AK007,008,012
38AKS008,009,012
Air-Cooled Condensing Units
50/60 Hz

Installation, Start-Up and Service Instructions

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SAFETY CONSIDERATIONS

Installing and servicing air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install or service air-conditioning equipment.

When working on air-conditioning equipment, observe precautions in literature and on tags and labels attached to unit. Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions *thoroughly.* Consult local building codes and National Electrical Code (NEC) (U.S.A. Standard) for special installation requirements.

⚠ WARNING

Before installing or servicing system, always turn off main power to system. There may be more than one disconnect switch. Electrical shock can cause personal injury.

INSTALLATION

The 38AK007, 008, and 012 units use hermetic compressors. The 38AKS008, 009, and 012 units use semi-hermetic compressors. See Table 1A or 1B for physical data.

Step 1 — Complete Pre-Installation Checks

UNCRATE UNIT (See Fig. 1) — Remove unit packaging except for the top skid assembly and wood bumpers, which should be left in place until after unit is rigged into place.

INSPECT SHIPMENT — File claim with shipping company if shipment is damaged or incomplete.

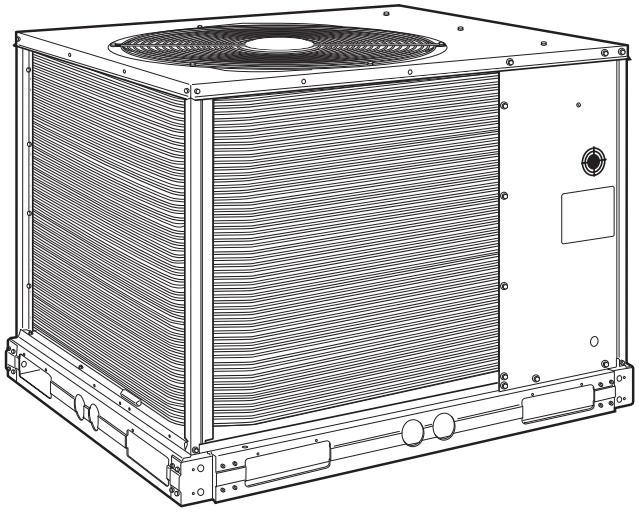


Fig. 1 — Model 38AK (Size 007 Shown)

Table 1A — Physical Data — 50/60 Hz (English)

UNIT 38	AK007	AK008	AK012	AKS008	AKS009	AKS012
OPERATING WEIGHT (lb)						
Aluminum Coils (Standard)	340	370	395	510	564	564
Copper Coils (Optional)	386	438	472	578	632	632
RIGGING WEIGHT (lb)						
Aluminum Coils (Standard)	390	420	445	560	614	614
Copper Coils (Optional)	436	488	522	628	682	682
REFRIGERANT*	R-22					
COMPRESSOR	Bristol, Reciprocating	Copeland, Scroll	Copeland, Scroll	Reciprocating, Semi-Hermetic		
Quantity...Type	1...H26A72Q	1...ZR94KC	1...ZR125KC	1...06DA818	1...06DA824	1...06DH824 (See Note)
Quantity Cylinders	2	—	—	4	6	
Speed (rpm) — 60 Hz	3500	3500	3500	1750	1750	
— 50 Hz				1460	1460	
Oil Charge (oz)	65	85	110	88	128	
CONDENSER FAN — 60 Hz	Propeller; Direct Drive					
Quantity...Rpm	1...850	1...1100				
Diameter (in.)	26	26				
Motor Hp (NEMA)	1/3	3/4				
Nominal Airflow (cfm)	3800	6500	7000	6500	6500	6500
CONDENSER FAN — 50 Hz	Propeller; Direct Drive					
Quantity...Rpm	1...960					
Diameter (in.)	26					
Motor Hp (NEMA)	1/3					
Nominal Airflow (cfm)	3150	5400	5800	5400	5400	5400
CONDENSER COIL	Enhanced Copper Tubes, Aluminum Lanced Fins					
Face Area (sq ft)	12.24	15.75	20.5	18.0	18.0	18.0
Storage Capacity (lb)†	11.26	14.88	18.87	16.56	16.56	16.56
CONNECTIONS (sweat)						
Suction (in.)	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8
Liquid (in.)	1/2	1/2	5/8	1/2	5/8	5/8
CONTROLS						
Pressurestat Settings (psig)						
High Cutout			426 ± 7			
Cut-in			320 ± 20			
Low Cutout			7 ± 3			
Cut-in			22 ± 5			

LEGEND

NEMA — National Electrical Manufacturing Association

*Unit is factory supplied with holding charge only.
†Storage capacity of condenser coil with coil 80% full of liquid R-22 at 124 F.

NOTE: Unit 38AKS012 has one step of unloading. Full load is 100% capacity, and one step of unloading is 67% capacity. Unit 38AKS012 has the following unloader settings: load is 70 ± 1 psig and unload is 60 ± 2 psig.

Table 1B — Physical Data — 50/60 Hz (SI)

UNIT 38	AK007	AK008	AK012	AKS008	AKS009	AKS012
OPERATING WEIGHT (kg)						
Aluminum Coils (Standard)	154	168	179	231	256	256
Copper Coils (Optional)	175	199	214	262	287	287
RIGGING WEIGHT (kg)						
Aluminum Coils (Standard)	176	191	202	254	279	279
Copper Coils (Optional)	198	221	237	285	309	309
REFRIGERANT*	R-22					
COMPRESSOR	Bristol, Reciprocating	Copeland, Scroll	Copeland, Scroll	Reciprocating, Semi-Hermetic		
Quantity...Type	1...H26A72Q	1...ZR94KC	1...ZR125KC	1...06DA818	1...06DA824	1...06DH824 (See Note 1)
Quantity Cylinders	2	—	—	4	6	
Speed (r/s) — 60 Hz	58.4	58.4	58.4	29.2	29.2	
— 50 Hz	48.4	48.4	48.4	24.2	24.2	
Oil Charge (L)	1.92	2.51	3.25	2.60	3.78	
CONDENSER FAN — 60 Hz	Propeller; Direct Drive					
Quantity...R/s	1...14.2	1...18.3				
Diameter (mm)	660	660				
Motor Hp (NEMA)	1/3	3/4				
Nominal Airflow (L/s)	1800	3050	3300	3050	3050	3050
CONDENSER FAN — 50 Hz	Propeller; Direct Drive					
Quantity...R/s	1...16.0					
Diameter (mm)	660					
Motor Hp (NEMA)	1/3					
Nominal Airflow (L/s)	1490	2550	2750	2550	2550	2550
CONDENSER COIL	Enhanced Copper Tubes, Aluminum Lanced Fins					
Face Area (sq m)	1.14	1.46	1.90	1.67	1.67	1.67
Storage Capacity (kg)†	5.1	6.75	8.6	7.5	7.5	7.5
CONNECTIONS (sweat)						
Suction (in.)	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8
Liquid (in.)	1/2	1/2	5/8	1/2	5/8	5/8
CONTROLS						
Pressurestat Settings (kPa)						
High Cutout			2937 ± 48			
Cut-in			2206 ± 138			
Low Cutout			48 ± 20			
Cut-in			151 ± 34			

LEGEND

NEMA — National Electrical Manufacturing Association

*Unit is factory supplied with holding charge only.
†Storage capacity of condenser coil with coil 80% full of liquid R-22 at 51 C.

NOTES:
1. Unit 38AKS012 has one step of unloading. Full load is 100% capacity, and one step of unloading is 67% capacity. Unit 38AKS012 has the following unloader settings: load is 483 ± 6.9 kPa and unload is 414 ± 13.8 kPa.
2. Equivalent mm values for connectors are as follows:

in.	mm
1/2	12.7
5/8	15.9
1 1/8	28.6

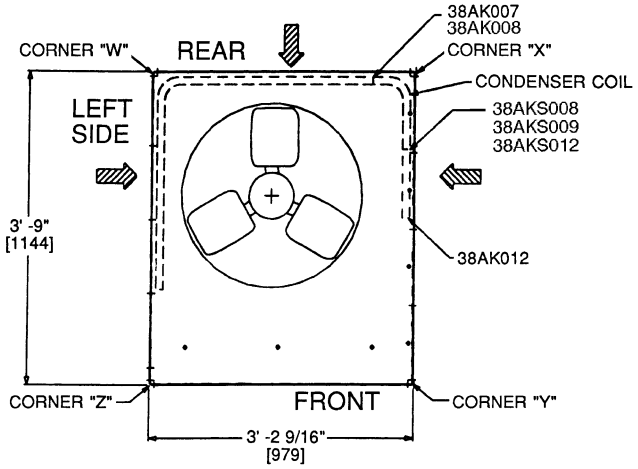
CONSIDER SYSTEM REQUIREMENTS

- Consult local building codes and NEC for special installation requirements.
- Allow sufficient space for airflow clearance, wiring, refrigerant piping, and unit servicing. See Fig. 2.
- Locate unit so that condenser airflow is unrestricted on all sides and above. Refer to Fig. 2.
- Unit may be mounted on a level pad directly on base rails or mounted on raised pads at support points. See Table 2 for weight distribution based on recommended support points.

NOTE: If vibration isolators are required for a particular installation, use corner weight information in Table 2 to make proper selection.

Table 2 — Weight Distribution

UNIT 38	WEIGHT CHART*									
	Std Unit		Corner W		Corner X		Corner Y		Corner Z	
	Lb	Kg	Lb	Kg	Lb	Kg	Lb	Kg	Lb	Kg
AK007	340	154	86	39	53	24	77	35	124	56
AK008	370	168	86	39	78	35	99	45	107	49
AK012	395	179	89	40	92	42	109	49	105	48
AKS008	510	231	115	52	89	40	133	60	173	87
AKS009	564	256	133	60	97	44	141	64	193	88
AKS012	564	256	133	60	97	44	141	64	193	88



*Weights are for aluminum coils.

NOTES:
1. Dimensions in [ ] are in millimeters.
2. See Fig. 3 for additional information.

Step 2 — Rig and Mount the Unit

⚠ CAUTION

Be sure unit panels are securely in place prior to rigging.

RIGGING — These units are designed for overhead rigging. Refer to rigging label for preferred rigging method. Spreader bars are not required if top crating is left on unit. All panels must be in place when rigging. (See Fig. 3.) As further protection for coil faces, plywood sheets may be placed against sides of unit, behind cables. Run cables to a central suspension point so that angle from the horizontal is not less than 45 degrees. Raise and set unit down carefully.

If it is necessary to roll unit into position, mount unit on rails, using a minimum of 3 rollers. *Apply force to rails, not unit.* If unit is to be skidded into position, place it on a large pad and drag it by the pad. *Do not apply any force to unit.*

Raise from above to lift unit from rails or pad when unit is in final position.

After unit is in position, remove all shipping materials and top crating.

COMPRESSOR MOUNTING — Compressors are shipped from the factory held down by 4 bolts. After unit is installed, loosen each bolt until the snubber washer can be moved with finger pressure. See Fig. 4.

Step 3 — Complete Refrigerant Piping Connections — Suction connection is sweat with plastic cap; liquid connection is sweat with plastic cap. Refer to Table 3A or 3B for the proper line sizes. Follow standard piping practices.

SIZE REFRIGERANT LINES — Consider length of piping required between condensing unit and air handler, amount of liquid lift, and compressor oil return. See Table 4A and 4B and also refer to Part 3 of Carrier System Design Manual for design details and line sizing. Refer to air handler installation instructions for additional information.

Table 3A — Refrigerant Piping Sizes — 60 Hz

UNIT 38	LINEAR LENGTH OF PIPING — FT (M)							
	0-25 (0-7.6)		25-50 (7.6-15.2)		50-75 (15.2-22.9)		75-100 (22.9-30.5)	
	Line Size (in. OD)							
	L	S	L	S	L	S	L	S
AK007	½	1⅛	½	1⅛	½	1⅛	½	1⅛
AK008	½	1⅛	½	1⅛	⅝	1⅛	⅝	1⅜
AK012	⅝	1⅛	⅝	1⅜	⅝	1⅜	⅝	1⅜
AKS008	½	1⅛	½	1⅛	⅝	1⅛	⅝	1⅜
AKS009	⅝	1⅛	⅝	1⅛	⅝	1⅜	⅝	1⅜
AKS012	⅝	1⅛	⅝	1⅛	⅝	1⅜	⅝	1⅜

LEGEND

L — Liquid Line
S — Suction Line

Table 3B — Refrigerant Piping Sizes — 50 Hz

UNIT 38	LINEAR LENGTH OF PIPING — FT (M)							
	0-25 (0-7.6)		25-50 (7.6-15.2)		50-75 (15.2-22.9)		75-100 (22.9-30.5)	
	Line Size (in. OD)							
	L	S	L	S	L	S	L	S
AK007	½	1⅛	½	1⅛	½	1⅛	½	1⅛
AK008	½	1⅛	½	1⅛	⅝	1⅜	⅝	1⅜
AK012	⅝	1⅛	⅝	1⅜	⅝	1⅜	⅝	1⅜
AKS008	½	1⅛	½	1⅛	⅝	1⅜	⅝	1⅜
AKS009	⅝	1⅛	⅝	1⅛	⅝	1⅜	⅝	1⅜
AKS012	⅝	1⅛	⅝	1⅛	⅝	1⅜	⅝	1⅜

LEGEND

L — Liquid Line
S — Suction Line

NOTES FOR TABLES 3A AND 3B:
1. Pipe sizes are based on a 2 F (1 C) loss for liquid and suction lines.
2. Pipe sizes are based on the maximum linear length shown for each column, plus a 50% allowance for fittings.
3. Charge units with R-22 in accordance with unit installation instructions.
4. Line size conversion to mm is:

in.	mm
½	12.7
⅝	15.9
1⅛	28.6
1⅜	34.9

UNIT 38	DIM. A	DIM. B	DIM. C	DIM. D	DIM. E	DIM. F
AK007	1′-6½″ [470.0]	1′-2¾″ [375.0]	— —	1′-2¼″ [362]	1′-4⁵⁄₁₆″ [415]	2′-9⁵⁄₁₆″ [846.5]
AK008	1′-8″ [508.0]	1′-6½″ [470.0]	— —	1′-3″ [381]	2′-⁵⁄₁₆″ [613]	3′-5⁷⁄₁₆″ [1052.5]
AK012	1′-9″ [533.4]	1′-8″ [508.0]	2′-0″ [609.6]	1′-3″ [381]	2′-⁵⁄₁₆″ [613]	3′-5⁷⁄₁₆″ [1052.5]
AKS008	1′-6″ [457.2]	1′-4¾″ [425.5]	2′-9¹³⁄₁₆″ [858.8]	1′-3″ [381]	2′-⁵⁄₁₆″ [613]	3′-5⁷⁄₁₆″ [1052.5]
AKS009	1′-7″ [482.6]	1′-5″ [431.8]	2′-9¹³⁄₁₆″ [858.8]	1′-3″ [381]	2′-⁵⁄₁₆″ [613]	3′-5⁷⁄₁₆″ [1052.5]
AKS012	1′-7″ [482.6]	1′-5″ [431.8]	2′-9¹³⁄₁₆″ [858.8]	1′-3″ [381]	2′-⁵⁄₁₆″ [613]	3′-5⁷⁄₁₆″ [1052.5]

NOTES:
1. Dimensions in [ ] are in millimeters.
2. Center of Gravity. See chart for dimensions.
3. Direction of Airflow.
4. Minimum clearance (local codes or jurisdiction may prevail):
   a. Condenser coil, for proper airflow, 36 in. [914] one side, 12 in. [305] the other. The left or rear side getting the greater clearance is optional.
   b. Overhead, 60 in. [1524] to assure proper condenser fan operation.
   c. Between units, control box side, 42 in. [1067] per NEC (National Electrical Code) (U.S.A. Standard).
   d. Between unit and ungrounded surfaces, control box side, 36 in. [914] per NEC.
   e. Between unit and block or concrete walls and other grounded surfaces, control box side, 42 in. [1067] per NEC.
5. With the exception of the clearance for the condenser coil as stated in Note 4b, a removable fence or barricade requires no clearance.
6. Units may be installed on combustible floors made from wood or Class A, B, or C roof covering material.

ELECTRICAL CONNECTIONS

CONNECTION SIZES	
AA	1⅜″ Dia [35] Field Power Supply Hole
BB	2″ Dia [51] Power Supply Knock-out
CC	2½″ Dia [64] Power Supply Knock-out
DD	⅞″ Dia [22] Field Control Wiring Hole

SERVICE VALVE CONNECTIONS — 50/60 Hz

UNIT 38	SUCTION	LIQUID
AK007	1⅛″ [28.6]	½″ [12.7]
AK008	1⅛″ [28.6]	½″ [12.7]
AK012	1⅛″ [28.6]	⅝″ [15.9]
AKS008	1⅛″ [28.6]	½″ [12.7]
AKS009	1⅛″ [28.6]	⅝″ [15.9]
AKS012	1⅛″ [28.6]	⅝″ [15.9]

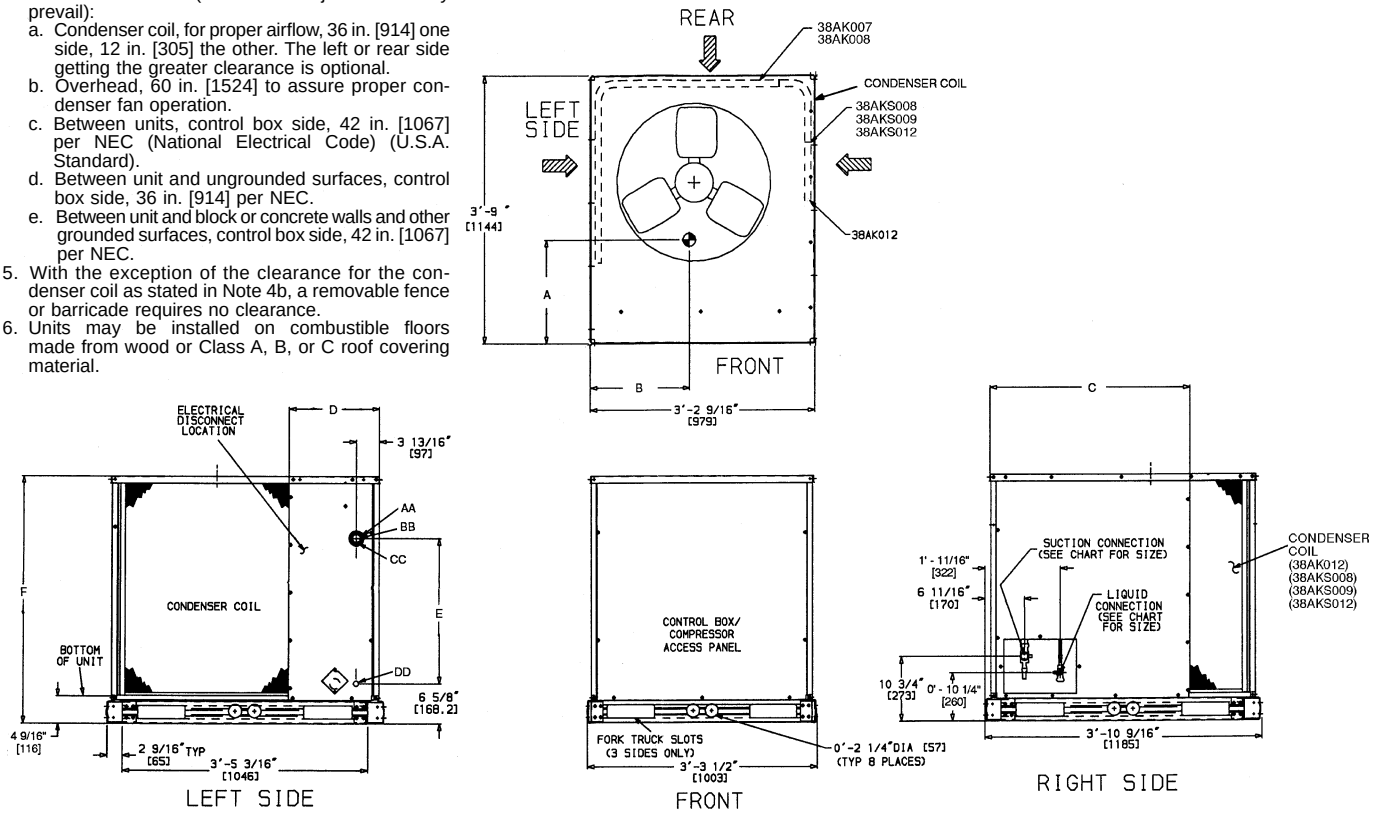
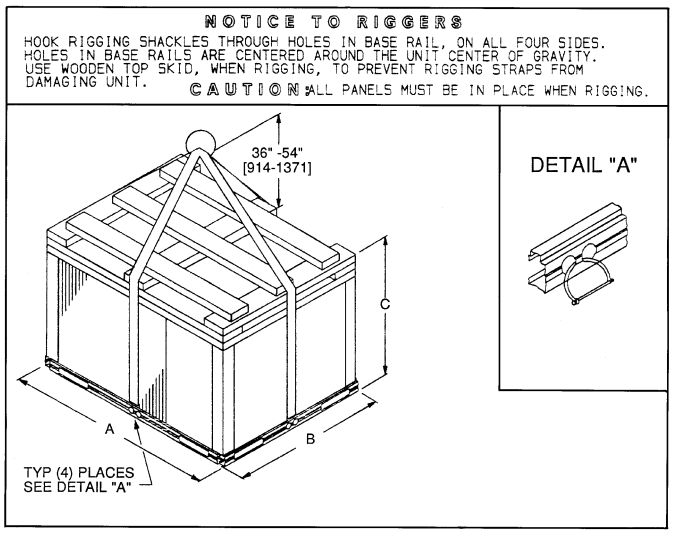


Fig. 2 — Dimensions (ft-in.)


NOTICE TO RIGGERS
HOOK RIGGING SHACKLES THROUGH HOLES IN BASE RAIL, ON ALL FOUR SIDES.
HOLES IN BASE RAILS ARE CENTERED AROUND THE UNIT CENTER OF GRAVITY.
USE WOODEN TOP SKID, WHEN RIGGING, TO PREVENT RIGGING STRAPS FROM DAMAGING UNIT.
CAUTION: ALL PANELS MUST BE IN PLACE WHEN RIGGING.
36″ -54″ [914-1371]
C
A
B
TYP (4) PLACES SEE DETAIL "A"
DETAIL "A"

UNIT 38	RIGGING WEIGHT*		A		B		C	
	lb	kg	in.	mm	in.	mm	in.	mm
AK007	390	176	45.0	1143	38.5	978	35.5	904
AK008	420	191	45.0	1143	38.5	978	43.5	1105
AK012	445	202	45.0	1143	38.5	978	43.5	1105
AKS008	560	254	45.0	1143	38.5	978	43.5	1105
AKS009	614	279	45.0	1143	38.5	978	43.5	1105
AKS012	614	279	45.0	1143	38.5	978	43.5	1105

*Weights are for aluminum coils.

Fig. 3 — Rigging Label

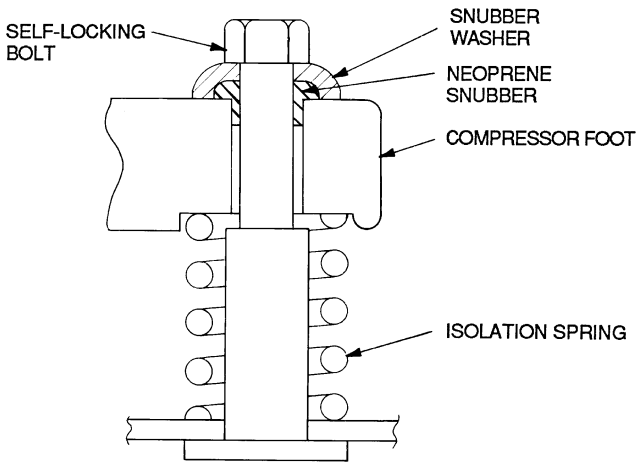


Fig. 4 — Typical Compressor Mounting (38AKS Units)

FILTER DRIER AND MOISTURE INDICATOR — The filter drier is factory installed. Moisture indicator is field-supplied and should be installed just after liquid line shutoff valve. *Do not use a receiver;* there is none provided with unit and one should not be used.

NOTE: Unit is shipped with R-22 holding charge. System pressure must be relieved before removing caps. Recover refrigerant prior to brazing.

Pass nitrogen or other inert gas through piping while brazing to prevent formation of copper oxide.

Install field-supplied thermostatic expansion valve to evaporator section. It is **recommended** that a field-supplied liquid line solenoid be positioned in the main liquid line close to the evaporator coil, and wired to close when compressor stops to minimize refrigerant migration during the ''OFF'' cycle.

Table 4A — Liquid Line Data — 60 Hz

UNIT 38	MAX ALLOWABLE LIQUID LIFT		LIQUID LINE			
			Max Allowable Pressure Drop		Max Allowable Temp Loss	
	Ft	M	psi	kPa	F	C
AK007	86	26.2	7	48.3	2	1
AK008	60	18.3	7	48.3	2	1
AK012	70	21.3	7	48.3	2	1
AKS008	60	18.3	7	48.3	2	1
AKS009	65	19.8	7	48.3	2	1
AKS012	65	19.8	7	48.3	2	1

NOTE: Values shown are for units operating at 45 F (7.2 C) saturated suction and 95 F (35 C) entering air.

Table 4B — Liquid Line Data — 50 Hz

UNIT 38	MAX ALLOWABLE LIQUID LIFT		LIQUID LINE			
			Max Allowable Pressure Drop		Max Allowable Temp Loss	
	Ft	M	psi	kPa	F	C
AK007	76	23.2	7	48.3	2	1
AK008	50	15.2	7	48.3	2	1
AK012	57	17.4	7	48.3	2	1
AKS008	50	15.2	7	48.3	2	1
AKS009	52	15.8	7	48.3	2	1
AKS012	52	15.8	7	48.3	2	1

NOTE: Values shown are for units operating at 45 F (7.2 C) saturated suction and 95 F (35 C) entering air.

Step 4 — Make Electrical Connections

⚠ WARNING

Unit cabinet must have an uninterrupted, unbroken electrical ground to minimize the possibility of personal injury if an electrical fault should occur. This ground may consist of electrical wire connected to unit ground lug in control compartment, or conduit approved for electrical ground when installed in accordance with NEC ANSI (American National Standards Institute)/NFPA (National Fire Protection Association) 70 (U.S.A. Standards) and local electrical codes. Failure to follow this warning could result in the installer being liable for personal injury of others.

FIELD POWER SUPPLY — All units except 208/230-v units are factory wired for the voltage shown on the nameplate. If the 208/230-v unit is to be connected to a 208-v power supply, the transformer *must* be rewired by moving the black wire from the 230-v orange wire on the transformer and connecting it to the 208-v red wire from the transformer. The end of the orange wire must then be insulated.

Refer to unit label diagram for additional information. Pigtails are provided for field wire connections. Use factory-supplied splices or UL (Underwriters' Laboratories) (U.S.A. Standard) approved copper/aluminum connector.

When installing units, provide a disconnect per NEC.

All field wiring must comply with NEC and local requirements.

Install field wiring as follows:

1. Install conduit through side panel openings.
2. Install power lines to connections as shown in Fig. 5. Wrap connections with electrical tape.

Voltage to compressor terminals during operation must be within voltage range indicated on unit nameplate (also see Table 5). Voltages between phases must be balanced within 2% and the current within 10%. Use the formula shown in Table 5, Note 2, to determine the percent voltage imbalance. *Operation on improper line voltage or excessive phase imbalance constitutes abuse and may cause damage to electrical components. Such operation would invalidate any applicable Carrier warranty.*

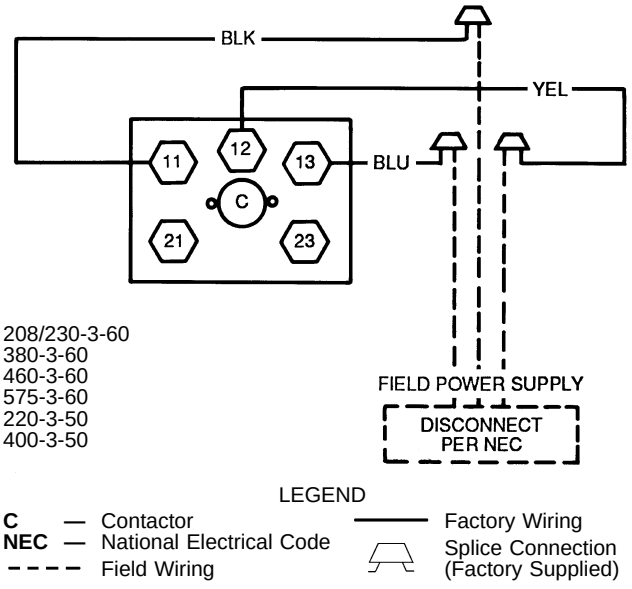


Fig. 5 — Power Wiring Connections

Table 5 — Electrical Data

UNIT 38	NOMINAL VOLTAGE (V-Ph-Hz)	VOLTAGE RANGE		COMPRESSOR		OFM	POWER SUPPLY	
		MIN	MAX	RLA	LRA	FLA	MCA	MOCP
AK007	208/230-3-60	187	254	21.8	142	1.9	25.6	35
	460-3-60	414	508	9.6	72	1.0	12.9	15
	575-3-60	518	632	7.6	58	1.9	11.4	15
	220-3-50	198	242	19.0	142	1.0	25.6	35
	400-3-50	360	440	9.5	72	1.0	12.9	15
AK008	208/230-3-60	187	254	28.8	195	3.8	39.8	45
	460-3-60	414	508	14.7	95	1.9	20.3	20
	575-3-60	518	632	10.8	80	1.9	15.4	15
	220-3-50	198	242	28.8	195	1.5	37.5	45
	400-3-50	360	440	14.7	90	1.5	19.9	20
AK012	208/230-3-60	187	254	37.8	239	3.1	46.2	60
	460-3-60	414	508	17.2	125	1.4	22.7	30
	575-3-60	518	632	12.3	80	1.4	19.3	25
	220-3-50	198	242	37.8	239	1.4	46.2	60
	400-3-50	360	440	17.2	125	1.4	22.7	30
AKS008	208/230-3-60	187	254	31.5	160	3.1	42.5	50
	380-3-60	342	418	19.0	75	2.2	26.0	35
	460-3-60	414	508	15.7	80	1.4	21.0	25
	575-3-60	518	632	12.6	64	1.4	17.2	20
	220-3-50	198	253	31.5	160	1.4	42.5	50
	400-3-50	342	460	15.7	80	1.4	21.0	25
AKS009	208/230-3-60	187	254	39.7	198	3.1	52.7	70
	380-3-60	342	418	24.0	93	2.2	32.2	40
	460-3-60	414	508	19.9	99	1.4	26.3	35
	575-3-60	518	632	15.9	79	1.4	21.3	25
	220-3-50	198	253	39.7	198	1.4	52.7	70
	400-3-50	342	460	19.9	99	1.4	26.3	35
AKS012	208/230-3-60	187	254	39.7	198	3.1	52.7	70
	380-3-60	342	418	24.0	93	2.2	32.2	40
	460-3-60	414	508	19.9	99	1.4	26.3	35
	575-3-60	518	632	15.9	79	1.4	21.3	25
	220-3-50	198	253	39.7	198	1.4	52.7	70
	400-3-50	342	460	19.9	99	1.4	26.3	35

LEGEND

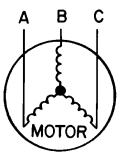
CSA — Canadian Standards Association
FLA — Full Load Amps
HACR — Heating, Air Conditioning and Refrigeration
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps
MOCP — Maximum Overcurrent Protection
NEC — National Electrical Code (U.S.A. Standard)
OFM — Outdoor (Condenser) Fan Motor
RLA — Rated Load Amps
UL — Underwriters' Laboratories

NOTES:
1. In compliance with NEC requirements for multimotor and combination load equipment (refer to NEC Articles 430 and 440), the overcurrent protective device for the unit shall be fuse or HACR breaker.
2. **Unbalanced 3-Phase Supply Voltage**

   Never operate a motor where a phase imbalance in supply voltage is greater than 2%. Use the following formula to determine the percent voltage imbalance.

$$= 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

EXAMPLE: Supply voltage is 460-3-60.



AB =452 v
BC =464 v
AC =455 v

$$\text{Average Voltage} = \frac{452 + 464 + 455}{3}$$

$$= \frac{1371}{3}$$

$$= 457$$

(AB) 457 - 452 =5 v
(BC) 464 - 457 =7 v
(AC) 457 - 455 =2 v

Maximum deviation is 7 v.

Determine percent voltage imbalance

$$\% \text{ Voltage Imbalance} = 100 \times \frac{7}{457}$$

$$= 1.53\%$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately.

3. The 575-v units are CSA only.
4. The 380 v, 60 Hz units and all 50 Hz units are *not* UL or CSA listed.

FIELD CONTROL WIRING — Install a Carrier-approved accessory thermostat assembly according to installation instructions included with the accessory. Locate thermostat assembly on a solid wall in the conditioned space to sense average temperature in accordance with thermostat installation instructions.

Route thermostat cable or equivalent single leads of colored wire from subbase terminals to low-voltage connections on unit (shown in Fig. 6) as described in Steps 1 through 3 below.

NOTE: For wire runs, use the following insulated wire:

LENGTH		INSULATION RATING (C)	SIZE	
Ft	M		AWG	sq mm
0-50	0-15.2	35	18	0.82
50-75	15.2-22.9	35	16	1.30
Over 75	Over 22.9	35	14	2.08

AWG — American Wire Gage

All wire larger than no. 18 AWG cannot be directly connected to the thermostat and will require a junction box and splice at the thermostat.

1. Connect thermostat wires to screw terminals of low-voltage connection board.
2. Pass the control wires through the hole provided in the corner post. (See Fig. 7.)
3. Feed wire through the raceway built into the corner post and into the 24 v thermostat connection board. The 24 v thermostat connection is located on the left side of the low-voltage connection compartment. The raceway provides the UL required clearance between high- and low-voltage wiring.

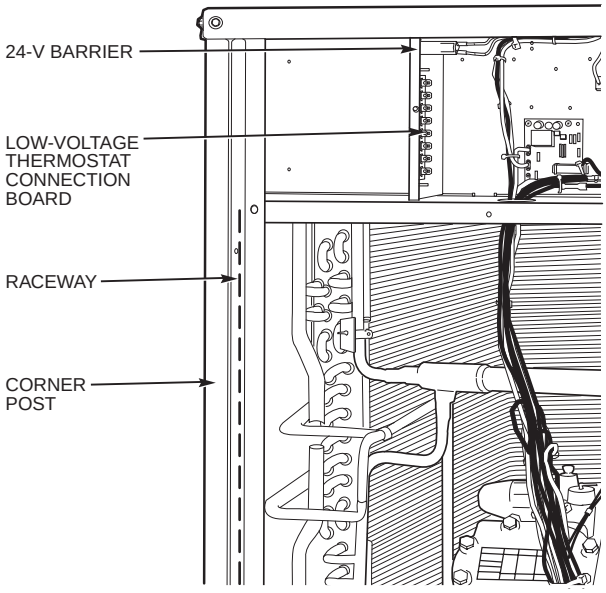


Fig. 7 — Field Control Wiring Raceway (38AKS Unit Shown)

Total combined amperage drain of the field-installed liquid line solenoid valve and indoor (evaporator) fan contactor must not exceed 22 va. If the specified va must be exceeded, use a remote relay to switch the load.

LEGEND

AHA — Adjustable Heat Anticipator
C — Contactor, Compressor
CB — Circuit Breaker
CC — Cooling Compensator
CLO — Compressor Lockout
HPS — High-Pressure Switch
IFC — Indoor (Evaporator) Fan Contactor
LLSV — Liquid Line Solenoid Valve
LPS — Low-Pressure Switch
TB — Terminal Block
TC — Thermostat-Cooling
TDR — Time-Delay Relay
TH — Thermostat-Heating
TRAN — Transformer
Terminal (Marked)
Splice
Factory Wiring
Field Control Wiring
To Indicate Common Potential Only; Not to Represent Wiring

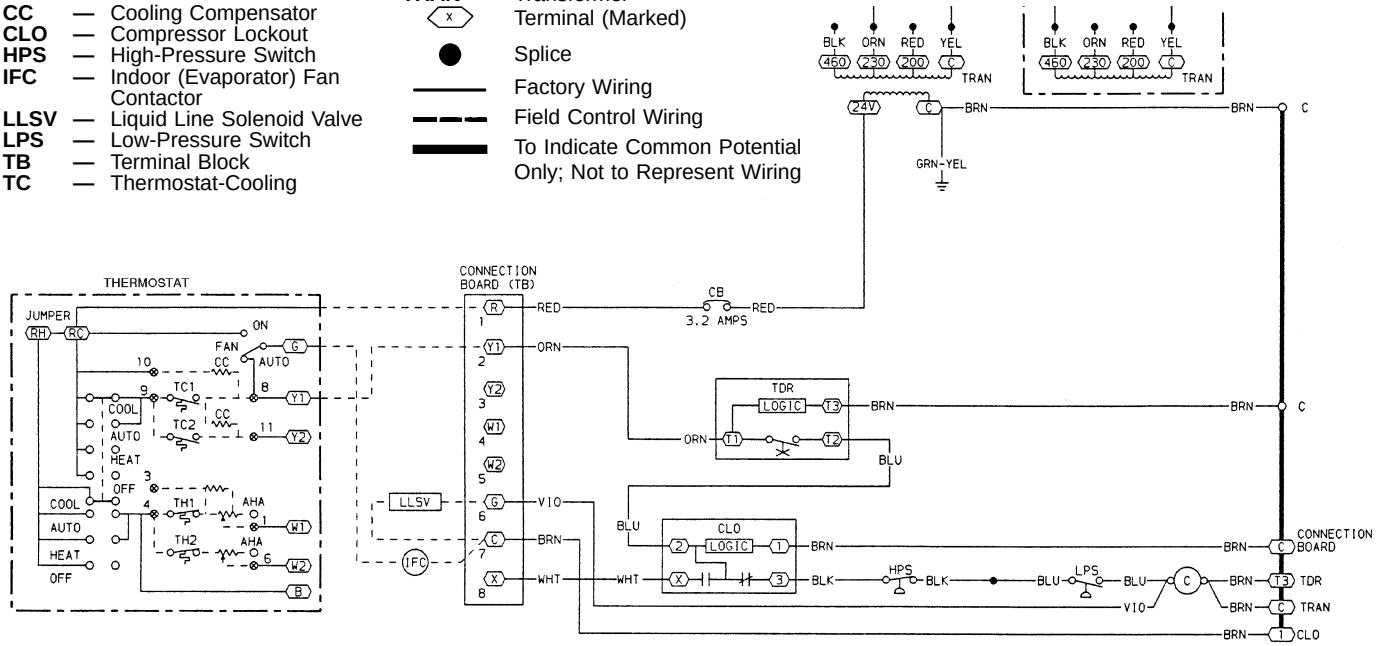


Fig. 6 — Typical Control Wiring Connections (38AK Shown)

START-UP

Preliminary Checks

1. Field electrical power source must agree with unit nameplate rating.
2. Check that all internal wiring connections are tight and that all barriers, covers, and panels are in place.
3. Ensure all service valves are open. On 38AKS units, be sure all compressor service valves are backseated.
4. Verify that compressor holddown bolts for units 38AKS have been loosened and that flat/snubber washers can be rotated by applying finger pressure (snug, but not tight).
5. Verify compressor crankcase heater is securely in place. Crankcase heater must operate for at least 24 hours before start-up. The 38AK unit size 007 does not require a crankcase heater.
6. Note that compressor oil level is visible in the sight glass (38AKS units only).
7. Check for leaks in refrigerant system by using soap bubbles and/or electronic leak detector.
8. Check that liquid line solenoid valve is located at evaporator coil as shown in Filter Drier and Moisture Indicator section, page 6.
9. Check voltage imbalance as shown in Table 5, Note 2.
10. Check that both outdoor and indoor units are properly mounted in accordance with installation instructions and applicable codes.

Evacuate and Dehydrate — Evacuate and dehydrate entire refrigerant system by use of the methods described in Carrier GTAC II, Module 4, System Dehydration. Evacuate system down to 500 microns and ensure vacuum hold for 15 minutes. If vacuum does not hold, pressurize system and locate leak and repair.

Refrigerant Charge — Refer to Carrier GTAC II, Module 5, Charging Recovery, Recycling, and Reclamation.

NOTE: Use of a Carrier Totalclaim® refrigeration recovery unit is highly recommended when recovering refrigerant.

Unit panels must be in place when unit is operating during charging procedure.

Unit is shipped with holding charge only. Weigh in 7 lb (3 kg) of R-22 to start unit.

CHARGE COOLING — Use Cooling Charging Charts, Fig. 8A or 8B and 9A or 9B. Vary refrigerant until the conditions of the chart are met. Note that charging charts are different from type normally used. Charts are based on charging the units to the correct subcooling for the various operating conditions. Accurate pressure gage and temperature sensing device are required. Connect the pressure gage to the service port on the liquid line service valve. Mount the temperature sensing device on the liquid line, close to the liquid line service valve and insulate it so that outdoor ambient temperature does not affect the reading. Indoor airflow must be within the normal operating range of the unit.

Operate unit a minimum of 15 minutes. Ensure pressure and temperature readings have stabilized. Plot liquid pressure and temperature on chart and add or reduce charge to meet curve. Adjust charge to conform with charging chart, using liquid pressure and temperature to read chart.

Compressor Overload — This overload interrupts power to the compressor when either the current or internal motor winding temperature becomes excessive, and automatically resets when the internal temperature drops to a safe level. This overload may require up to 60 minutes (or longer) to reset. If the internal overload is suspected of being open, disconnect the electrical power to the unit and check the circuit through the overload with an ohmmeter or continuity tester.

Cycle-LOC™ Device — When high-pressure or low-pressure fault occurs, the Cycle-LOC device will protect the system by not allowing the compressor to start.

Low-Pressure/Loss-of-Charge Switch (LPS) — When the liquid line pressure drops below 7 psig (48 kPa), the LPS opens 24-v power to the compressor contactor and stops the compressor. When the pressure reaches 22 psig (152 kPa), the switch resets and the compressor is allowed to restart.

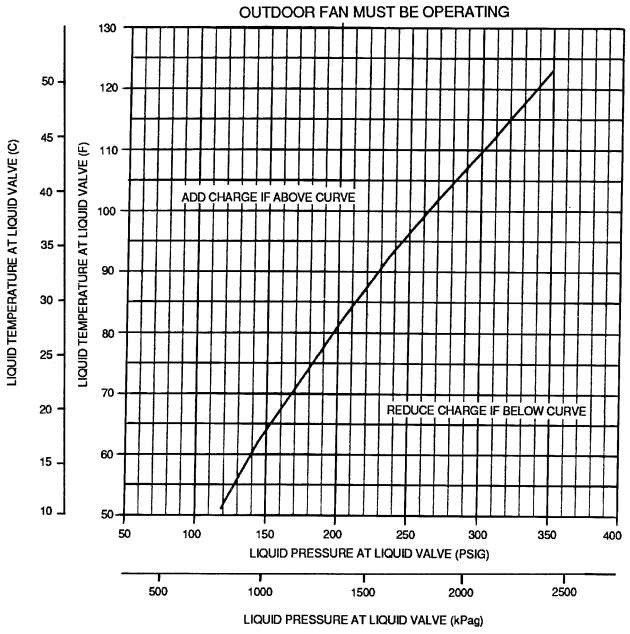

OUTDOOR FAN MUST BE OPERATING
LIQUID TEMPERATURE AT LIQUID VALVE (C)
LIQUID TEMPERATURE AT LIQUID VALVE (F)
ADD CHARGE IF ABOVE CURVE
REDUCE CHARGE IF BELOW CURVE
LIQUID PRESSURE AT LIQUID VALVE (PSIG)
LIQUID PRESSURE AT LIQUID VALVE (kPag)

Fig. 8A — Cooling Charging Chart — 38AK007 (60 Hz)

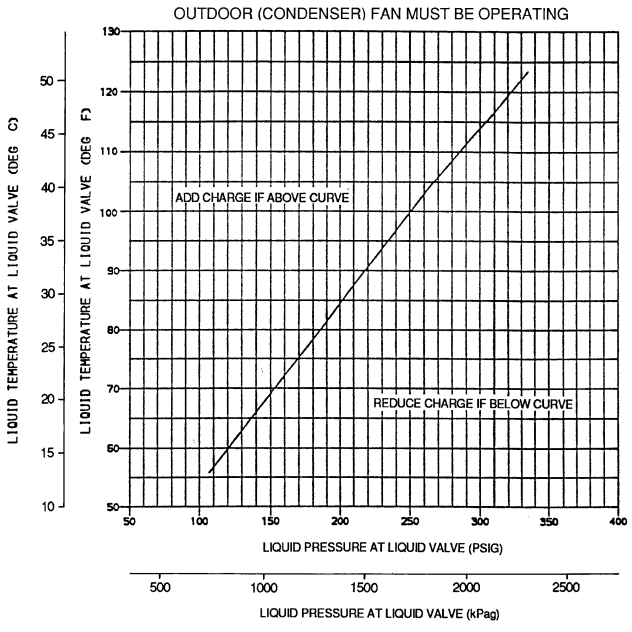

OUTDOOR (CONDENSER) FAN MUST BE OPERATING
LIQUID TEMPERATURE AT LIQUID VALVE (DEG C)
LIQUID TEMPERATURE AT LIQUID VALVE (DEG F)
ADD CHARGE IF ABOVE CURVE
REDUCE CHARGE IF BELOW CURVE
LIQUID PRESSURE AT LIQUID VALVE (PSIG)
LIQUID PRESSURE AT LIQUID VALVE (kPag)

Fig. 8B — Cooling Charging Chart — 38AK007 (50 Hz)

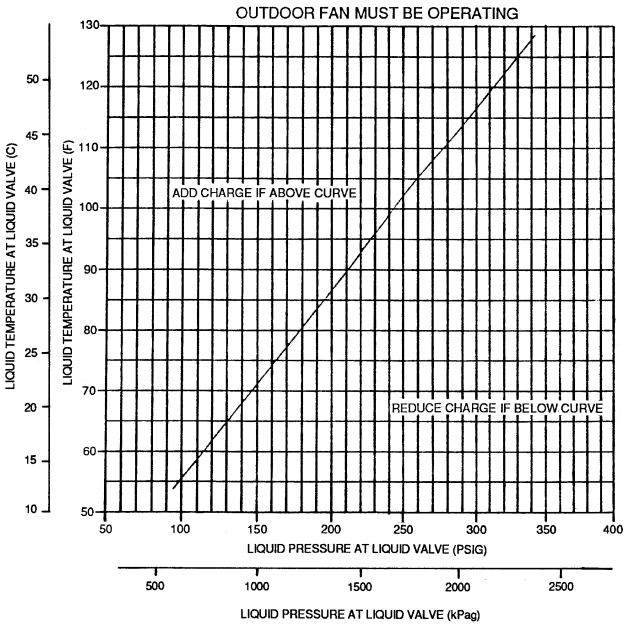

OUTDOOR FAN MUST BE OPERATING
LIQUID TEMPERATURE AT LIQUID VALVE (C)
LIQUID TEMPERATURE AT LIQUID VALVE (F)
ADD CHARGE IF ABOVE CURVE
REDUCE CHARGE IF BELOW CURVE
LIQUID PRESSURE AT LIQUID VALVE (PSIG)
LIQUID PRESSURE AT LIQUID VALVE (kPag)

Fig. 9A — Cooling Charging Chart — 38AK008,012 and 38AKS008,009,012 (60 Hz)

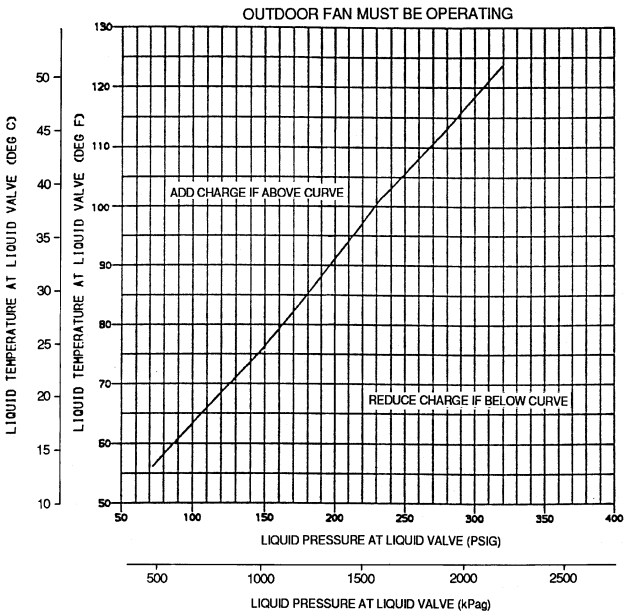

OUTDOOR FAN MUST BE OPERATING
LIQUID TEMPERATURE AT LIQUID VALVE (DEG C)
LIQUID TEMPERATURE AT LIQUID VALVE (DEG F)
ADD CHARGE IF ABOVE CURVE
REDUCE CHARGE IF BELOW CURVE
LIQUID PRESSURE AT LIQUID VALVE (PSIG)
LIQUID PRESSURE AT LIQUID VALVE (kPag)

Fig. 9B — Cooling Charging Chart — 38AK008,012 and 38AKS008,009,012 (50 Hz)

High-Pressure Switch (HPS) — When the refrigerant high-side pressure reaches 426 psig (2937 kPa), the HPS opens 24-v power to the compressor contactor and stops the compressor. When the pressure drops to 320 psig (2206 kPa), the switch resets and the compressor is allowed to restart.

Time Guard® II Device — Time Guard II circuit provides for a delay of approximately 5 minutes before restarting compressor after shutdown from safety device action.

On start-up, the Time Guard II timer causes a delay of approximately 15 seconds after thermostat closes.

Refrigerant Service Ports — Each unit system has 3 service ports: one on the suction line, one on the liquid line, and one on the compressor discharge line. Be sure caps on the ports are tight.

Cooling — Set space thermostat to OFF position. Set system selector switch at COOL position and fan switch at AUTO. position. Adjust thermostat to a setting below room temperature. Compressor starts on closure of contactor.

Check cooling effects at a setting below room temperature. Check unit charge. Refer to Refrigerant Charge section on page 9.

Reset thermostat at a position above room temperature. Compressor will shut off.

TO SHUT OFF UNIT — Set system selector switch at OFF position. (Resetting thermostat at a position above room temperature shuts unit off temporarily until space temperature exceeds thermostat setting.) Units are equipped with Cycle-LOC™ protection device. Unit shuts down on any safety trip and remains off. Check reason for safety trip.

Compressor restart is accomplished by manual reset of the thermostat by turning the selector switch to OFF position and then to ON position.

Sequence of Operation — At start-up, the thermostat calls for cooling. With all safety devices satisfied, the compressor contactor and fan contactor energize, causing the compressor and outdoor (condenser) fan motor to operate. Contacts close, allowing the field-supplied and -installed indoor (evaporator) fan contactor to function. The recommended field-supplied and -installed liquid line solenoid valve will also open, allowing the system to function in cooling. As cooling demand is satisfied, the thermostat contacts break, deenergizing the contactor causing the system to shut off. The liquid line solenoid valve closes, minimizing the potential for refrigerant migration at this time. The compressor does not restart until the thermostat again calls for cooling. If a demand for cooling occurs within 5 minutes after the thermostat is satisfied, the system will not restart due to the feature of Time Guard II device. After the 5-minute time period, the system will restart as normal on thermostat demand. The system is protected by a Cycle-LOC device so that the compressor will not start if a high-pressure or low-pressure fault occurs. Compressor restart is accomplished by manual reset of the thermostat by turning the selector switch to OFF position and then to ON position. This should be done only once. If system shuts down due to the same fault, determine the problem before attempting to reset the Cycle-LOC device.

Oil Charge (Tables 1A and 1B)

38AKS UNITS — Allow unit to run for about 20 minutes. Stop unit and check compressor oil level. Add oil only if necessary to bring oil into view in sight glass. *Use only Carrier-approved compressor oil.*

Approved oils are:
Suniso 3GS
WF32-150

38AK UNITS — The 38AK units do not have a sight glass and are factory charged with the correct amount of oil.

ALL UNITS — *Do not reuse drained oil or use any oil that has been exposed to atmosphere.* Procedures for adding or removing oil are given in Carrier Standard Service Techniques Manual, Chapter 1, Refrigerants.

If oil is added, run unit for an additional 10 minutes. Stop unit and check oil level. If level is still low, add oil *only after* determining that piping system is designed for proper oil return and that system is not leaking oil.

SERVICE

⚠ CAUTION

When servicing unit, shut off all electrical power to the unit to avoid shock hazard or injury from rotating parts.

Cleaning — Inspect unit interior at the beginning of each cooling season and as operating conditions require.

CONDENSER COIL — Inspect coil monthly. Clean condenser coil annually and as required by location or outdoor-air conditions.

Clean coil as follows:

1. Turn off unit power.
2. Remove and save top panel screws on condensing unit.
3. Remove condenser coil corner post. See Fig. 10. To hold top panel open, place coil corner post between top panel and side panel. See Fig. 11.
4. Remove bracket holding coil sections together at return end of condenser coil. Carefully separate the outer coil section 3 to 4 in. (75 to 100 mm) from the inner coil section. See Fig. 12.
5. Use a water hose or other suitable equipment to flush down between the 2 coil sections to remove dirt and debris. Clean the outer surfaces with a stiff brush in the normal manner.
6. Reposition the outer coil section, and secure the coil sections together by reinstalling the brackets removed in Step 4.
7. Remove the coil corner post from between the top panel and side panel.
8. Install the coil corner post and replace all screws removed in Step 2.

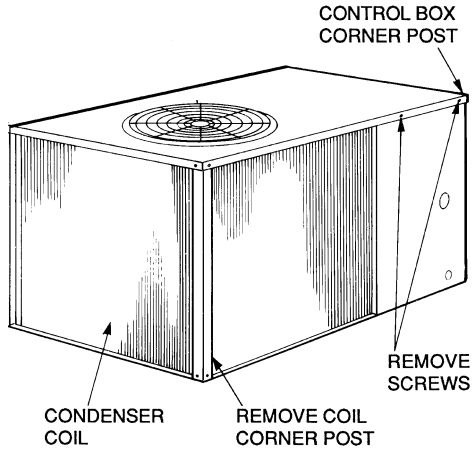


Fig. 10 — Cleaning Condenser Coil

Lubrication

COMPRESSORS — Each compressor is charged with correct amount of oil at the factory. For additional information on 38AKS units, refer to the Oil Charge section on page 10.

FAN MOTOR BEARINGS — Fan motor bearings are of the permanently-lubricated type. No further lubrication is required.

Condenser-Fan Adjustment (Fig. 13)

1. Shut off unit power supply.
2. Remove condenser-fan assembly (grille, motor, motor cover, and fan).

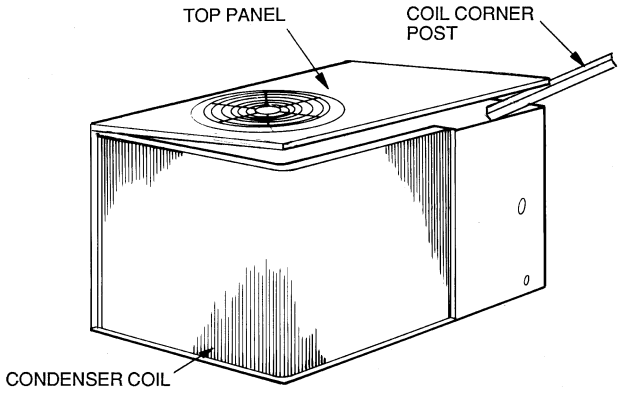


Fig. 11 — Propping Up Top Panel

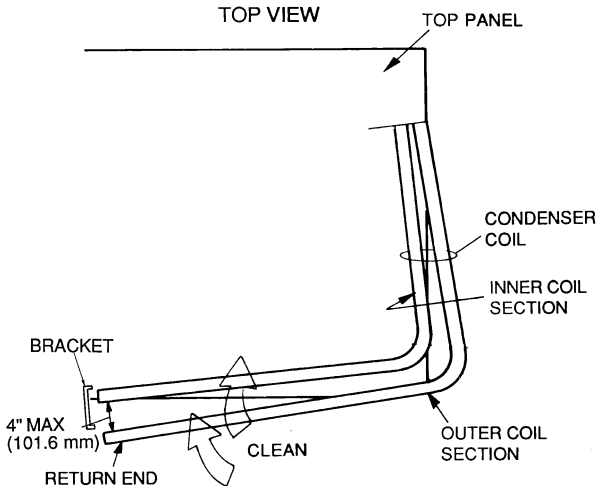
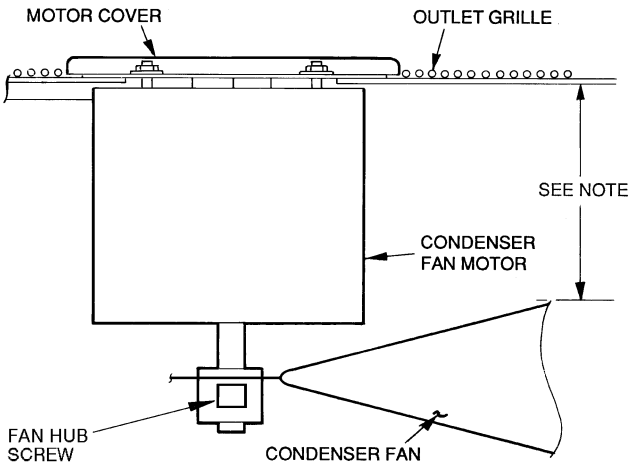


Fig. 12 – Separating Coil Sections



NOTE: Fan height adjustments are as follows:

UNIT	in.	mm
38AK007 (60 Hz) All 50-Hz Units	4.50	114
All 60-Hz Units (Except 38AK007)	6.42	163

Fig. 13 — Condenser-Fan Adjustment

3. Loosen fan hub setscrews.

4. Adjust fan height as shown in Fig. 13.
5. Tighten setscrews.
6. Replace condenser-fan assembly.

Capacity Control — Unit 38AKS012 Only — A suction pressure-actuated unloader controls 2 cylinders and provides capacity control. Unloaders are factory set (see Table 1A or 1B), but may be field adjusted as follows:

CONTROL SET POINT (cylinder load point) is adjustable from 0 to 85 psig (586 kPa). To adjust, turn control set point adjustment nut (Fig. 14) clockwise to its bottom stop. In this position, set point is 85 psig (586 kPa). Then, turn adjustment counterclockwise to desired control set point. Every full turn counterclockwise decreases set point by 7.5 psig (51.7 kPa).

PRESSURE DIFFERENTIAL (difference between cylinder load and unload points) is adjustable from 6 to 22 psig (41.4 to 152 kPa). To adjust, turn pressure differential adjustment screw (Fig. 14) counterclockwise to its back stop position. In this position, differential is 6 psig (41.4 kPa). Then, turn adjustment clockwise to desired pressure differential. Every full turn clockwise increases differential by 1.5 psig (10.3 kPa).

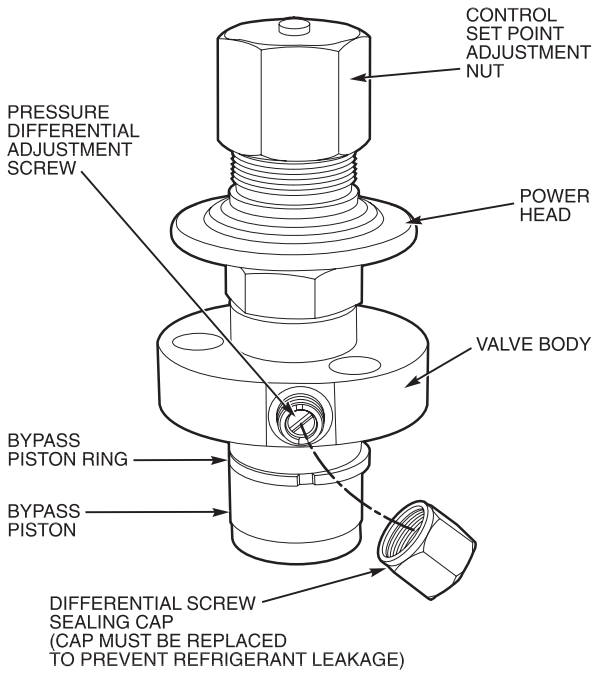

CONTROL SET POINT ADJUSTMENT NUT
PRESSURE DIFFERENTIAL ADJUSTMENT SCREW
POWER HEAD
VALVE BODY
BYPASS PISTON RING
BYPASS PISTON
DIFFERENTIAL SCREW SEALING CAP (CAP MUST BE REPLACED TO PREVENT REFRIGERANT LEAKAGE)

Fig. 14 — Compressor Capacity Control Unloader

Compressor Removal — See Tables 1A and 1B for compressor information. Follow safety codes and wear safety glasses and work gloves.

1. Shut off power to unit. Remove unit access panel (front of unit).
2. Remove refrigerant from system using refrigerant removal methods described in the Carrier GTAC-II, Module 5, Charging, Recovery, Recycling, and Reclamation.
3. Disconnect compressor wiring at compressor terminal box.
4. Remove bolts from suction flange and discharge service valves (38AKS008,009,012 units only). Loosen sweat connections (38AK007,008, and 012 units only).

⚠ CAUTION

Excessive movement of copper lines at compressor may cause higher levels of vibration when unit is restored to service.

5. Remove crankcase heater from compressor base (38AKS008,009,012, 38AK008,012).
6. Remove compressor holddown bolts.
7. Remove compressor from unit.
8. Clean system. Add new liquid line filter drier.
9. Install new compressor in unit.
10. Connect suction and discharge lines to compressor, as applicable. Ensure that compressor holddown bolts are in place.
11. Connect wiring.
12. Install crankcase heater on 38AKS008,009,012 and 38AK008,012 units.
13. Evacuate and recharge unit.
14. Restore unit power.

Crankcase Heater (Except 38AK007) — The crankcase heater on the 38AK008,012 condensing units prevents refrigerant migration and compressor oil dilution during shutdown when compressor is not operating.

Close both compressor service valves if applicable (on 38AKS008,009,012) when crankcase heater is deenergized for more than 6 hours.

TROUBLESHOOTING GUIDE

SYMPTOM	CAUSE	REMEDY
Compressor does not run — Contactor open	Power off.	Restore power.
	Fuses blown.	Replace with correct fuses after finding cause and correcting.
	Transformer open/shorted.	Replace transformer if primary windings are receiving power and no output.
	Thermostat circuit open.	Check thermostat setting.
	Low-pressure switch open.	Check for refrigerant undercharge or system leak.
	High-pressure switch open.	Check for refrigerant over charge or obstruction of outdoor airflow.
	Connections loose.	Tighten all connections.
	Compressor motor thermostat open.	Check for excessive motor temperature.
Compressor does not run — Contactor closed	Compressor leads loose, broken.	Check connections with power off.
	Single phasing.	Replace blown fuse.
	Compressor internal overload open.	Allow compressor motor windings to cool down to reset overload. Determine cause for overload opening.
Compressor cycles on high-pressure switch — Condenser fan on	High-pressure switch faulty.	Replace switch.
	Airflow restricted. Dirty coil.	Remove obstruction, clean condenser coil.
	Air recirculating.	Clear airflow area.
	Noncondensables in system.	Recover, evacuate and recharge as required. Refer to Carrier GTAC-II, Module 5, Charging, Recovery, Recycling, and Reclamation.
	Refrigerant overcharge.	Recover as required.
	Refrigerant system restrictions.	Check or replace filter drier, expansion valve, etc.
Compressor cycles on high-pressure switch — Condenser fan off	Fan slips on shaft.	Tighten fan hub screws.
	Motor not running.	Check power and capacitor ⅓ and ¾ hp motor.
	Motor bearings seized.	Replace motor.
	Motor overload open.	Check overload rating. Check for fan blade obstruction.
	Motor burned out, windings open.	Replace motor.
Compressor cycles on low-pressure switch — Evaporator fan running	Filter drier plugged.	Replace filter drier.
	Expansion valve power head defective.	Replace power head.
	Low refrigerant charge.	Find leak, repair, evacuate system, and recharge.
	Expansion valve restricted/plugged.	Remove and replace expansion valve.
Airflow restricted — Low suction pressure	Evaporator coil iced up.	Check refrigerant charge.
	Evaporator coil dirty.	Clean coil fins.
	Indoor-air filter dirty.	Clean or replace filters.
	Indoor-air dampers closed.	Check damper operation and position.
Indoor (evaporator) fan stopped — Low suction pressure	Electrical connections loose.	Tighten all connections.
	Fan relay defective.	Replace relay.
	Motor overload open.	Check power supply.
	Motor defective.	Replace motor.
	Fan belt broken or slipping.	Replace or tighten belt.
Compressor runs but cooling insufficient — Suction pressure low	Refrigerant charge low.	Add charge.
	Head pressure low.	Check refrigerant charge.
	Indoor-air filters dirty.	Clean or replace filters.
	Expansion valve power head defective.	Replace power head.
	Expansion valve restricted/plugged.	Remove and replace expansion valve.
	Evaporator coil partially iced.	Check low-pressure setting.
	Evaporator airflow restricted.	Remove obstruction.
Compressor runs but cooling insufficient — Suction pressure high	Heat load excessive.	Check for open doors or windows.

NOTE: See Fig. 15 and 16 for component arrangements.

LEGEND AND NOTES FOR FIG. 15 AND 16

C — Contactor, Compressor
CAP — Capacitor
CB — Circuit Breaker
CH — Crankcase Heater
CLO — Compressor Lockout
COMP — Compressor Motor
COTP — Compressor Temperature Protection
EQUIP — Equipment
GND — Ground
HPS — High-Pressure Switch
LPS — Low-Pressure Switch
NEC — National Electrical Code
OFC — Outdoor (Condenser) Fan Contactor
OFM — Outdoor (Condenser) Fan Motor
OL — Overload Relay
QT — Quadruple Terminal
TB — Terminal Block
TDR — Time-Delay Relay
TH — Thermostat-Heating
TRAN — Transformer

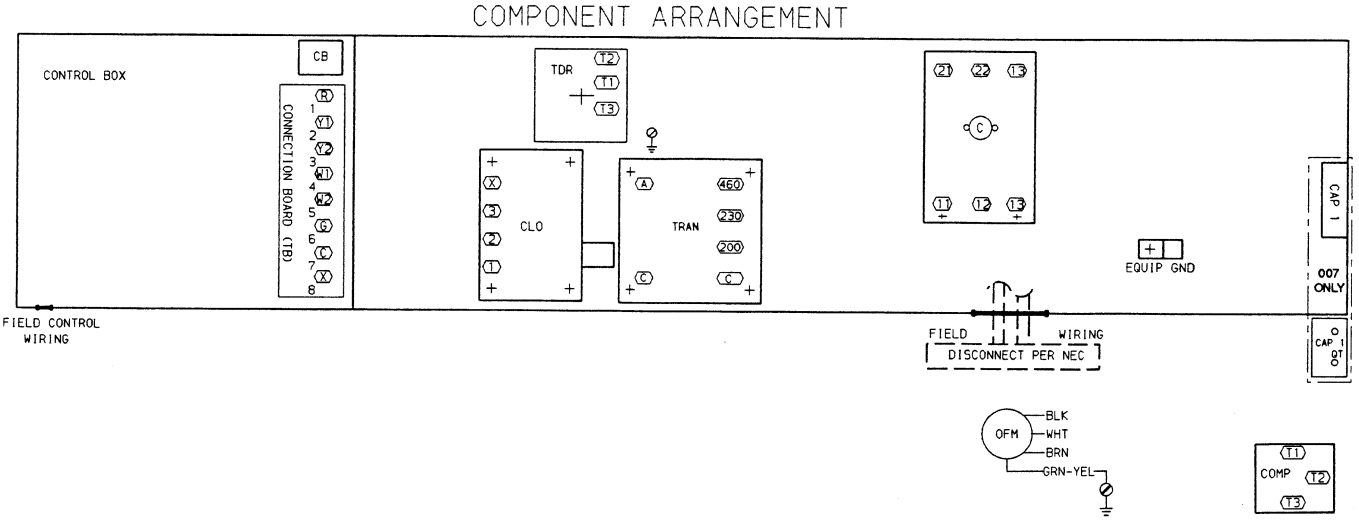


Fig. 15 — Typical 38AK Component Arrangement

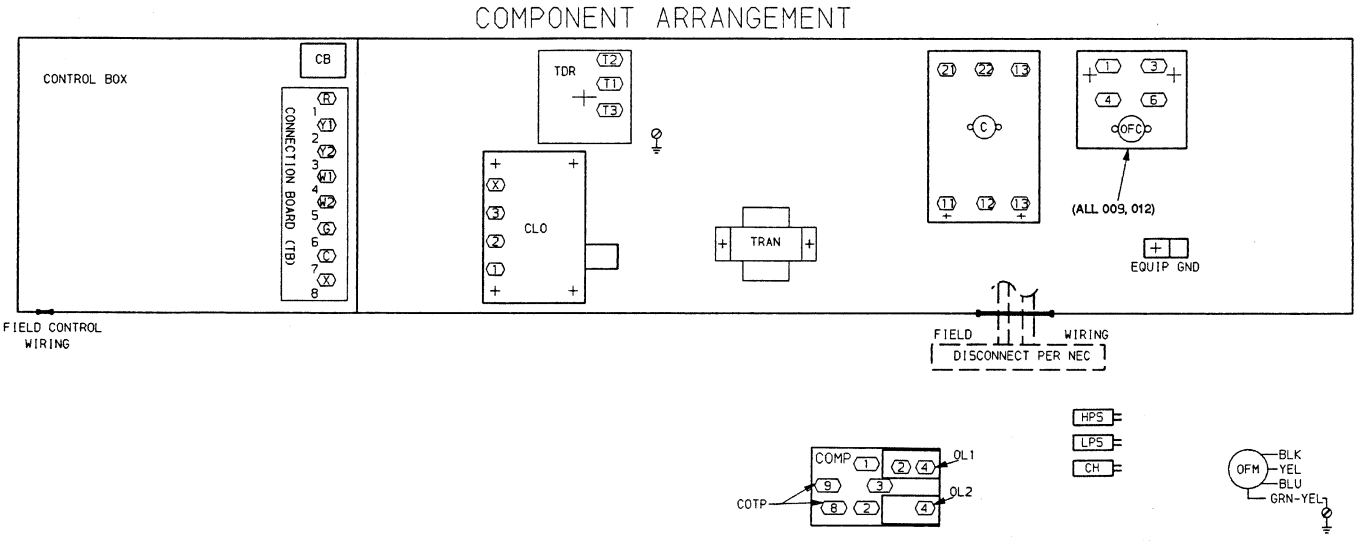


Fig. 16 — Typical 38AKS Component Arrangement

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START-UP CHECKLIST

A. Preliminary Information

OUTDOOR: MODEL NO. _____ SERIAL NO. _____

INDOOR: AIR HANDLER MANUFACTURER _____

MODEL NO. _____ SERIAL NO. _____

ADDITIONAL ACCESSORIES _____

B. Pre-Start-Up

OUTDOOR UNIT

IS THERE ANY SHIPPING DAMAGE? _____ (Y/N) _____

IF SO, WHERE: _____

_____

WILL THIS DAMAGE PREVENT UNIT START-UP? (Y/N) _____

CHECK POWER SUPPLY. DOES IT AGREE WITH UNIT? (Y/N) _____

HAS THE GROUND WIRE BEEN CONNECTED? (Y/N) _____

HAS THE CIRCUIT PROTECTION BEEN SIZED AND INSTALLED PROPERLY? (Y/N) _____

ARE THE POWER WIRES TO THE UNIT SIZED AND INSTALLED PROPERLY? (Y/N) _____

HAVE COMPRESSOR HOLDDOWN BOLTS BEEN LOOSENED (Snubber washers are snug, but not tight)? (Y/N) _____

CONTROLS

ARE THERMOSTAT AND INDOOR-FAN CONTROL WIRING CONNECTIONS MADE AND CHECKED? (Y/N) _____

ARE ALL WIRING TERMINALS (including main power supply) TIGHT? (Y/N) _____

HAS CRANKCASE HEATER BEEN ENERGIZED FOR 24 HOURS? (Y/N) _____

INDOOR UNIT

HAS WATER BEEN PLACED IN DRAIN PAN TO CONFIRM PROPER DRAINAGE? (Y/N) _____

ARE PROPER AIR FILTERS IN PLACE? (Y/N) _____

HAVE FAN AND MOTOR PULLEYS BEEN CHECKED FOR PROPER ALIGNMENT? (Y/N) _____

DO THE FAN BELTS HAVE PROPER TENSION? (Y/N) _____

HAS CORRECT FAN ROTATION BEEN CONFIRMED? (Y/N) _____

PIPING

IS LIQUID LINE SOLENOID VALVE LOCATED AT THE EVAPORATOR COIL AS REQUIRED? (Y/N) _____

HAVE LEAK CHECKS BEEN MADE AT COMPRESSOR, CONDENSER, EVAPORATOR, TXVs (Thermostatic Expansion Valves) SOLENOID VALVES, FILTER DRIERS, AND FUSIBLE PLUGS WITH A LEAK DETECTOR? (Y/N) _____

LOCATE, REPAIR, AND REPORT ANY LEAKS. _____

ON 38AKS UNIT, HAVE ALL COMPRESSOR SERVICE VALVES BEEN FULLY OPENED (BACKSEATED)? (Y/N) _____

HAVE LIQUID LINE SERVICE VALVE AND SUCTION LINE SERVICE VALVE BEEN OPENED? (Y/N) _____

IS THE OIL LEVEL IN THE COMPRESSOR CRANKCASE ON THE 38AKS UNIT IN VIEW IN THE COMPRESSOR SIGHT GLASS? (Y/N) _____

CUT ALONG DOTTED LINE

CHECK VOLTAGE IMBALANCE

LINE-TO-LINE VOLTS: AB _____ V AC _____ V BC_____ V

(AB + AC + BC)/3 = AVERAGE VOLTAGE = _____ V

MAXIMUM DEVIATION FROM AVERAGE VOLTAGE = _____ V

VOLTAGE IMBALANCE = 100 X (MAX DEVIATION)/(AVERAGE VOLTAGE) = _____ %

IF OVER 2% VOLTAGE IMBALANCE, DO NOT ATTEMPT TO START SYSTEM!
CALL LOCAL POWER COMPANY FOR ASSISTANCE.

C. Start-Up

CHECK INDOOR (EVAPORATOR) FAN SPEED AND RECORD. _____

CHECK OUTDOOR (CONDENSER) FAN SPEED AND RECORD. _____

AFTER AT LEAST 15 MINUTES RUNNING TIME, RECORD THE FOLLOWING MEASUREMENTS:

OIL PRESSURE (38AKS only)	_____
SUCTION PRESSURE	_____
SUCTION LINE TEMP	_____
DISCHARGE PRESSURE	_____
DISCHARGE LINE TEMP	_____
ENTERING CONDENSER-AIR TEMP	_____
LEAVING CONDENSER-AIR TEMP	_____
EVAP ENTERING-AIR DB (dry bulb) TEMP	_____
EVAP ENTERING-AIR WB (wet bulb) TEMP	_____
EVAP LEAVING-AIR DB TEMP	_____
EVAP LEAVING-AIR WB TEMP	_____

COMPRESSOR AMPS (L1/L2/L3) _____ / _____ / _____

HAS REFRIGERANT CHARGE BEEN ADJUSTED PER CHARGING CHARGE? _____

NOTES:

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